

AUG 06 1988

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FLOOD INSURANCE STUDY



VILLAGE OF COLON,
MICHIGAN

ST. JOSEPH COUNTY



COMPLETED

SEPTEMBER 16, 1988



Federal Emergency Management Agency

COMMUNITY NUMBER - 260511

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

VILLAGE OF COLON, ST. JOSEPH COUNTY, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and supersedes a previous Flood Insurance Rate Map for the Village of Colon, St. Joseph County, Michigan (Reference 1). This information will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by the Federal Emergency Management Agency (FEMA) for purposes of the National Flood Insurance Program.

The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, FEMA, Chicago, Illinois, for consideration for revision of this study.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were obtained from the Flood Insurance Study for the Township of Colon, Michigan (Reference 2).

1.3 Coordination

On October 5, 1987, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Colon, St. Joseph County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data.

Flooding caused by overflow of the St. Joseph River and Swan Creek was studied in detail. Portions of these streams, known as Sturgeon Lake and Palmer Lake, are also included in the detailed study.

2.2 Community Description

The Village of Colon is located in the northeastern quarter of the Township of Colon in eastern St. Joseph County in southern Michigan. The village is surrounded by the township. The Village of Colon is served by State Highway 86 and Conrail. The 1980 population of Colon was reported to be 1,190 (Reference 3).

Terrain in the area is fairly level and only slightly incised by watercourses. The annual average precipitation of the region is 34 inches, and the average snowfall is 40 inches (Reference 4).

2.3 Principal Flood Problems

High-water events in the Village of Colon tend to occur in the months of March and April, a time when runoff increases significantly because of spring rains, melting snow, and frozen ground. The greatest known discharge for Swan Creek, about 1,900 cubic feet per second (cfs), occurred in June 1937 and can be estimated as a 100-year event. Floods of March 1982 and February 1985 had discharges of about 1,400 cfs and 1,200 cfs and were estimated as 30-year and 18-year events, respectively.

Discharges of the St. Joseph River at Sturgeon Lake during the floods of March 1982 and February 1985 were 5,300 cfs and 5,000 cfs, respectively, with estimated recurrence intervals of 37 years and 27 years, respectively. On this river, floods of March 1980 and April 1950 were comparable to the March 1982 flood. Closely spaced piers of an abandoned railroad bridge produce a constriction in the St. Joseph River, downstream from the Township of Colon corporate limits. This constriction increases the backwater elevation of Sturgeon Lake during floodflows by about 0.5 foot. Flooding damage has occurred around Sturgeon Lake and the shores of Palmer Lake. Pictures of the June 26, 1937, flood show the inundation at the south end of Sturgeon Lake (Figure 2) and high water on the upstream side of State Street bridge over Swan Creek (Figure 3).



FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF COLON, MI
(ST. JOSEPH CO.)

APPROXIMATE SCALE

2 0 2 4 6 MILES

VICINITY MAP

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PHOTO 1 -



PHOTO 2 -

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2.4 Flood Protection Measures

Flood protection of Swan Creek by dredging parts of Palmer Lake in the southern part of the village and by improvements to the Swan Creek Dam has been studied by consultants (References 5 and 6). Control works for Swan Creek Dam consists of a row of flashboards that can be removed during floods. Use of the flashboards helps maintain a higher summer water level in Palmer Lake. Flashboards in the adjacent millrace can also be removed during flood conditions to alleviate flooding upstream on Swan Creek. This action, however, sometimes adds to the cresting of the St. Joseph River at Sturgeon Lake. The millrace dam at the outlet of Palmer Lake has been rebuilt. Operations of dams on the St. Joseph River are coordinated during high water.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Flood-frequency peak discharges computed for Swan Creek using regression data and comparisons with gaging stations in the area proved to be too low. Peak discharges for selected recurrence intervals were provided by the Michigan Department of Natural Resources using a Soil Conservation Service computer program in TR 20 (Reference 7), for runoff from small watersheds. Similar computations have been used in previous studies for the Colon area (References 5 and 6).

Flood-frequency peak discharges for the St. Joseph River were obtained from U.S. Geological Survey (USGS) gaging stations and a log-Pearson Type III distribution of annual peak flow data.

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
ST. JOSEPH RIVER just downstream of the corporate limits of the Township of Colon	712	4,100	5,580	6,210	7,740
at confluence of Swan Creek	587	3,100	3,980	4,310	5,140
SWAN CREEK at mouth	113	1,000	1,600	1,900	2,600
at confluence of Little Swan Creek	75	500	800	950	1,300

Elevations for floods of the selected recurrence intervals of Sturgeon Lake and Palmer Lake are shown in Table 2.

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATION (FEET NGVD)			
	10-YEAR	50-YEAR	100-YEAR	500-YEAR
STURGEON LAKE along shoreline	841.6	843.0	843.5	844.8
PALMER LAKE along shoreline	851.4	852.0	852.4	853.4

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections and dimensions of backwater-producing structures were obtained by field survey. A topographic map with 10-foot contour intervals (Reference 8) was used to locate cross sections and provide additional

terrain elevations.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas. Roughness values for the main channel of the St. Joseph River ranged from 0.025 to 0.038 while overbank roughness values ranged from 0.040 to 0.120 for all floods. Roughness values for the main channel of Swan Creek ranged from 0.024 to 0.080, while overbank roughness values ranged from 0.045 to 0.120 for all floods.

Starting water-surface elevations for the St. Joseph River were taken from a rating based on a high-water mark of the March 1982 flood, a discharge measurement made during the February 1985 flood, and a lower discharge measurement of May 1985.

Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USGS step-backwater computer model program, J-635 (Reference 9). The models were calibrated using water-surface profiles from floods of March 1982 and February 1985.

Elevations from the St. Joseph River were used for Swan Creek starting elevations. Starting elevations above the Swan Creek Dam, which create Long Lake and Palmer Lake, were computed using a standard weir formula for the dam and the millrace. The dam rating was checked with a high-water discharge measurement in the flood of February 1985.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 8).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. In Michigan though, under Michigan Act 245, Public Acts of 1929, as amended by Act 167, Public Acts of 1968 (Reference 10), encroachment in the floodplain is limited to that which will cause only an insignificant increase in flood heights. Thus, at the recommendation of the Bureau of the Water Management, a floodway having no more than a 0.1-foot surcharge has been delineated for this study. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of

the floodway computations are tabulated for selected cross sections and are shown in Table 3, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and the 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodways for the St. Joseph River lie outside the corporate limits.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

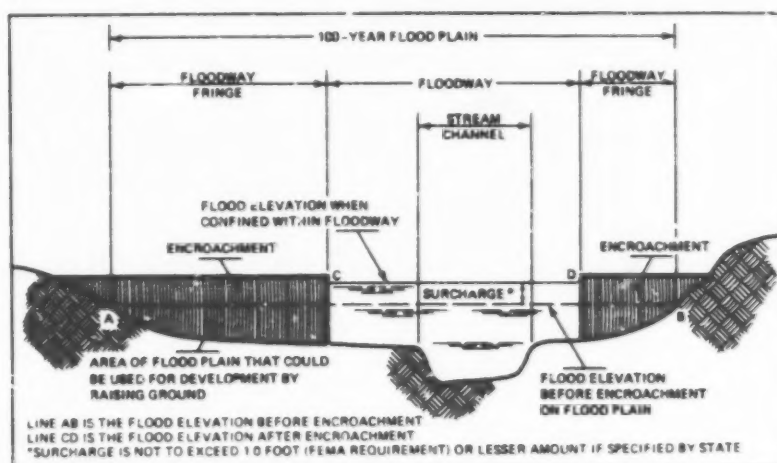


FIGURE 4 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
ST. JOSEPH RIVER								
B	24,800	1645 ³	8065	0.8	843.7	843.7	843.8	0.1
SWAN CREEK								
A	1750 ²	934	3271	0.6	844.0	842.5 ⁴	842.6	0.1
B	2580 ²	459	1957	1.0	844.1	843.1 ⁴	843.2	0.1
C	4730 ²	502	2822	0.7	844.6	844.6	844.7	0.1
D	6180 ²	451	1820	1.0	845.0	845.0	845.1	0.1

¹FEET ABOVE BENNETT ROAD

²FEET ABOVE MOUTH

³THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

⁴ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM ST. JOSEPH RIVER

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TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF COLON, MI
(ST. JOSEPH CO.)

FLOODWAY DATA

ST. JOSEPH RIVER—SWAN CREEK

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Flood Insurance Study is in progress for the Township of Colon, Michigan (Reference 2) and is in agreement with this study.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Insurance Rate Map for the Village of Colon (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

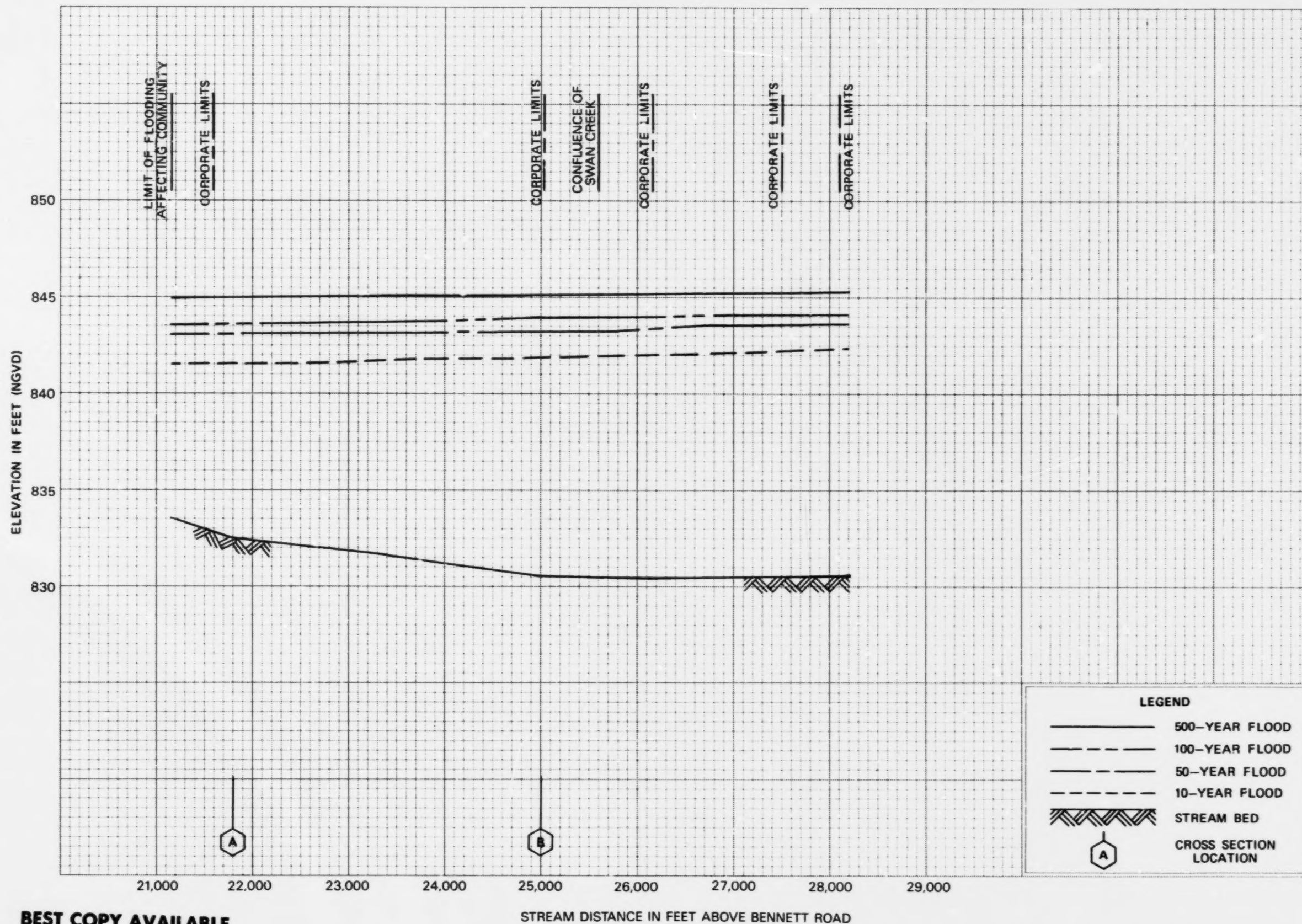
9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Rate Map, Village of Colon, St. Joseph County, Michigan, March 1979.
2. Federal Emergency Management Agency, Flood Insurance Study, Township of Colon, St. Joseph County, Michigan, in progress.
3. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population. Number of Inhabitants, Michigan, Washington, D.C., January 1982.
4. Michigan Weather Service, Climate of Michigan by Stations, 1971.
5. Snell Environmental Group, Engineers Study and Report on the Restoration of Long and Palmer Lakes, Colon, Michigan, Lansing, Michigan, June 1976.
6. Nordlund, Dunlap and Associates, Preliminary Investigation for Repairs and Renovation of Palmer Lake Dam, located in the Village of Colon, Michigan, Ludington, Michigan, March 1978.

7. U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, May 1965.
8. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Colon, Michigan, 1961.
9. ———, Users Guide, Step-Backwater and Floodway Analysis, Computer Program J-635, James O. Shearman, 1977.
10. State of Michigan, Floodplain Control Act of 1968, Act 245, P.A. 1929, as amended by Act 167, P.A. 1968, Michigan Water Resources Commission, Lansing, Michigan, 1968.

ELEVATION REFERENCE MARKS

<u>REFERENCE MARK</u>	<u>FLOOD INSURANCE RATE MAP PANEL</u>	<u>ELEVATION (FEET NGVD)</u>	<u>DESCRIPTION OF LOCATION</u>
1	0005	838.06	chiseled cross on top of easterly flange bolt of fire hydrant located at northeast corner of intersection of State Street and Elizabeth Street
2	0005	852.39	chiseled square in center of top of left abutment of the Conrail bridge over Swan Creek
3	0005	853.85	chiseled square on sidewalk at the northwest corner of Sports Marina located near east side of Swan Creek Dam



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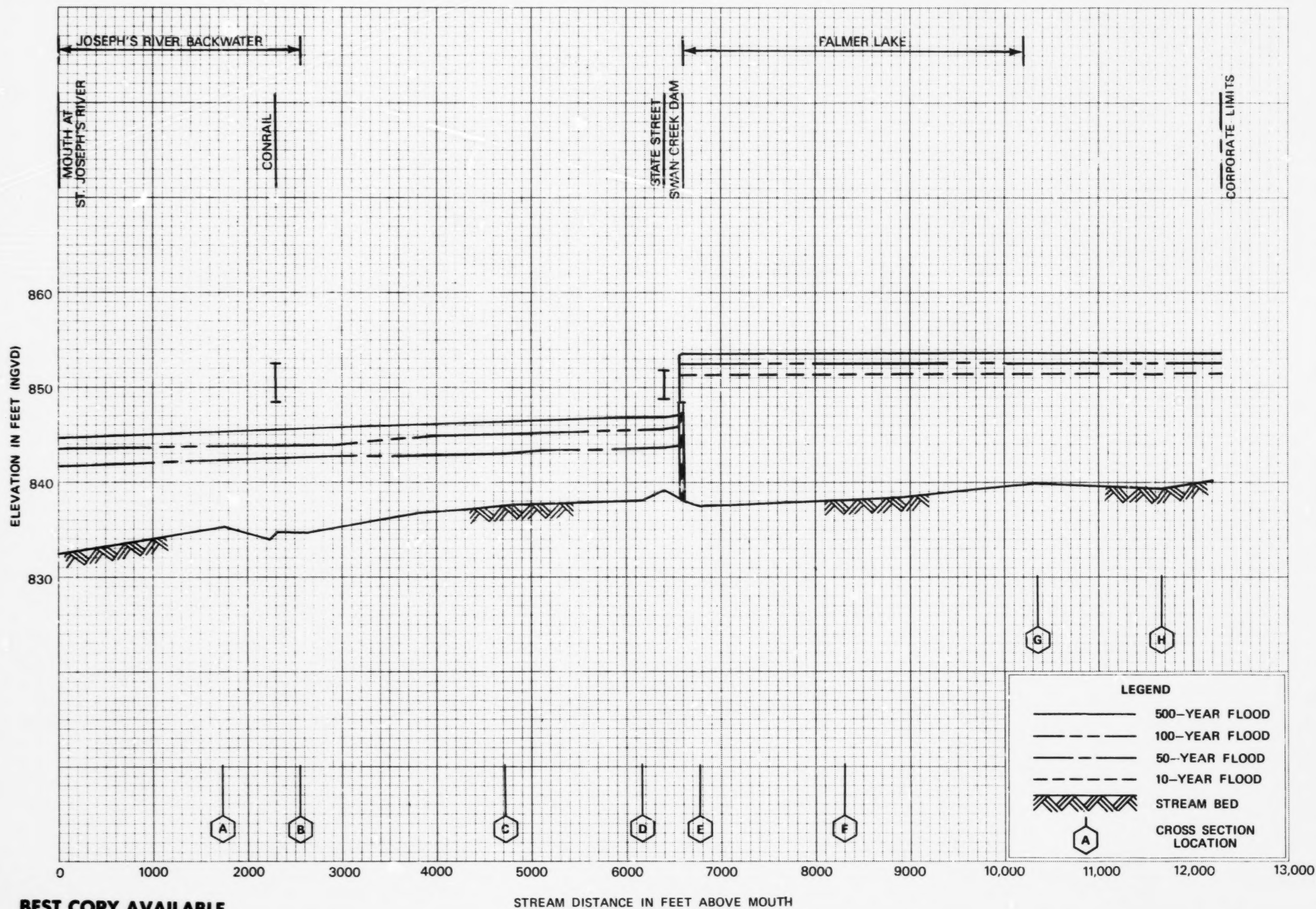
FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF COLON, MI
(ST. JOSEPH CO.)

FLOOD PROFILES

ST. JOSEPH RIVER

01P



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FLOOD PROFILES

SWAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF COLON, MI
(ST. JOSEPH CO.)

02P